

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
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SRM Number: 3168a
MSDS Number: 3168a
SRM Name: Zinc Standard Solution
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Zinc Standard Solution

Description: SRM 3168a is a single element solution prepared gravimetrically to contain a nominal concentration of 10 mg/g of zinc with a nitric acid volume fraction of 10 %.

Other Designations: **Zinc** (blue powder) in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; nitryl hydroxide; nital); **Zinc Nitrate**^a (zinc dinitrate; zinc (II) nitrate) in **Standard Solution**

Name	Chemical Formula	CAS Registry Number
Nitric Acid	HNO ₃	7697-37-2
Zinc Nitrate	Zn(NO ₃) ₂	7779-88-6
Zinc	Zn	7440-66-6

^aThe addition of zinc to nitric acid, along with other intermediate chemical reactions, forms zinc nitrate, which will precipitate upon evaporation or drying of the solution.

DOT Classification: Nitric Acid Solution, UN2031

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Acid	10	ACGIH TWA: 5 mg/m ³
		ACGIH STEL: 10 mg/m ³
		OSHA STEL: 10 mg/m ³
		OSHA TWA: 5 mg/m ³
		Rat, Inhalation: LC ₅₀ : 6250 mg/m ³ /1 h
		Human, Oral: LD _{Lo} : 430 mg/kg
Zinc Nitrate	2.9	No occupational exposure limits established
		Rabbit, Skin: 500 mg/24 h (severe irritation)
		Rat, Oral: LD ₅₀ : 2500 mg/kg
Zinc	1.0	OSHA TWA: 5 mg/m ³ (as ZnO) (respirable dust) 5 mg/m ³ (as ZnO) (fume)
		ACGIH TWA: 2 mg/m ³ (as ZnO) (respirable fraction)
		Human, Skin: 300 µg/3 d (skin irritation)
		Human, Inhalation: TC _{Lo} : 124 mg/m ³ /50 min

NOTE: The exposure limits and toxicity data are for the pure components. Data **DO NOT** exist for this zinc/nitric acid solution.

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Zinc Nitrate	Zinc
Appearance and Odor: a colorless to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; irritating odor	Appearance and Odor: colorless to white, hygroscopic crystals with an astringent taste; odorless	Appearance and Odor: white powder; odorless
Molecular Weight: 63.01	Molecular Weight: 189.39	Molecular Weight: 65.38
Specific Gravity: 1.054 (10 % nitric acid)	Specific Gravity: not applicable	Specific Gravity (water = 1): 7.14
Water Solubility: soluble	Water Solubility: soluble	Water Solubility: reacts with water
Solvent Solubility: soluble in ether	Solvent Solubility: not applicable	Solvent Solubility: soluble in alcohol, alkali materials, and acetic acid

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this zinc/nitric acid solution **DO NOT** exist. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Nitric Acid, Zinc Nitrate:

Flash Point: Not Applicable **Method Used:** Not Applicable **Autoignition Temperature:** Not Applicable

Flammability Limits in Air (Volume %): **UPPER:** Not Applicable
LOWER: Not Applicable

Zinc:

Flash Point: Not Applicable **Method Used:** Not Applicable **Autoignition Temperature:** Not Applicable

Flammability Limits in Air (Volume %): **UPPER:** Not Applicable
LOWER: 0.5 g/L

Zinc Standard Solution:

Unusual Fire and Explosion Hazards: Although nitric acid, zinc nitrate, and zinc are negligible fire hazards, nitric acid and zinc nitrate are powerful oxidizing agents that can react with combustible materials to cause fires.

Extinguishing Media: Use an extinguishing agent most appropriate to extinguish surrounding fire. **DO NOT** use halogenated extinguishing agents, carbon dioxide, or dry chemicals.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Zinc Standard Solution:

Stability: X **Stable** **Unstable**

Zinc standard solution is stable under normal temperature and pressure.

Conditions to Avoid: Avoid heat and contact with combustible and other incompatible materials. Keep out of water supplies and sewers.

See Section IV: "Unusual Fire and Explosion Hazards".

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid and/or zinc nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor. Thermal decomposition of zinc may release zinc oxides.

Hazardous Polymerization: **Will Occur** X **Will Not Occur**

Incompatibility (Materials to Avoid):

Nitric Acid: Nitric acid is incompatible with acids, combustible materials, halo carbons, amines, bases, oxidizing materials, metals, halogens, metal salts, metal oxides, reducing agents, peroxides, metal carbide, and cyanides.

Zinc Nitrate: Zinc nitrate is incompatible with acids, combustible materials, cyanides, metals, metal salts, and reducing agents.

Zinc: Zinc is incompatible with acids, bases, metals, oxidizing materials, reducing agents, halo carbons, metals, halogens, combustible materials, metal oxides, and amines.

SECTION VI. HEALTH HAZARD DATA

Route of Entry (Zinc Standard Solution): X **Inhalation** X **Skin** X **Ingestion**

Health Hazards (Acute and Chronic): Nitric Acid: This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.

Health Hazards (Acute and Chronic): Nitric Acid is irritating to the respiratory system. Contact to the eyes, skin and mucous membranes can cause burns and pain.

Eye Contact: Direct eye contact may cause pain and lacrimation, photophobia, and burns, possibly severe. The degree of injury depends on the concentration and duration of contact. In mild burns, the epithelium regenerates rapidly and the eye recovers completely. In severe cases, the whole cornea may become deeply vascularized and opaque resulting in blindness. Repeated or prolonged exposure to acidic substances may cause conjunctivitis or effects as in acute exposure.

Skin Contact: Direct skin contact with liquid or vapor may cause severe pain and burns. Repeated or prolonged contact may result in dermatitis or effects similar to acute exposure. Effects depend on the concentration and duration of exposure.

Inhalation: Inhalation of acidic substances may cause severe respiratory irritation with coughing, choking, and possibly burns of the mucous membranes. Other initial symptoms may include dizziness, headache, nausea, and weakness. Pulmonary edema may be immediate in the most severe exposures. Death due to anoxia may occur within a few hours after onset of the symptoms of pulmonary edema or following a relapse. Repeated or prolonged exposure may cause erosion of the teeth, inflammatory and ulcerative changes in the mouth, and possible jaw necrosis. Bronchial irritation with cough and frequent attacks of bronchial pneumonia may occur.

Ingestion: Ingestion of nitric acid may cause burns, corrosion of the mucous membranes of the mouth, throat, and esophagus, pain, and difficulty in swallowing or speaking. Epiglottal edema may result in respiratory distress and possibly asphyxia. Shock with marked hypotension, weak, rapid pulse, shallow respiration, and clammy skin may occur. Circulatory collapse may ensue and if uncorrected, lead to renal failure. Depending on the concentration, repeated ingestion of acidic substances may result in inflammatory and ulcerative changes in the mucous membranes of the mouth and other effects as in acute ingestion.

Zinc Nitrate may be irritating to the respiratory tract, skin, and eyes. Zinc nitrate may be harmful if ingested.

Eye Contact: Direct eye contact may cause delayed irritation with redness, pain, and blurred vision. Repeated and prolonged exposure to zinc nitrate may cause conjunctivitis.

Skin Contact: Contact may cause irritation with redness, pain, and possibly skin burns. Chronic exposure may cause dermatitis.

Inhalation: Inhalation of dust may cause irritation of the nose and throat, coughing, labored breathing, and possibly lung edema. There is no data for chronic exposure.

Ingestion: Short term exposure may cause sore throat, metallic taste, diarrhea, nausea, and vomiting. Long term exposure may cause digestive disorders, shock, collapse, and possible death.

Zinc may be irritating to the skin, eyes, and respiratory system. Ingestion of zinc is harmful.

Eye Contact: Direct contact of zinc may cause irritation and possible corneal burns. There is no data for chronic exposure.

Skin Contact: Zinc may cause irritation and mild dermatitis. Chronic exposure may cause symptoms similar to acute exposure.

Inhalation: Zinc dust may cause irritation with difficulty in breathing. Chronic exposure of zinc dust may cause gastrointestinal disturbances.

Ingestion: Large oral doses may cause abdominal pain, diarrhea, dehydration, nausea, vomiting, fever, dizziness, internal bleeding, and kidney damage. Long term exposure may cause nausea, loss of appetite, weight loss, headache, dizziness and pain in extremities.

Listed as a Carcinogen/Potential Carcinogen (Nitric Acid, Zinc Nitrate, Zinc):

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens		X
In the International Agency for Research on Cancer (IARC) Monographs		X
By the Occupational Safety and Health Administration (OSHA)		X

Emergency and First Aid Procedures (Zinc Standard Solution):

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain immediate medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration by qualified personnel. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Obtain immediate medical assistance.

TARGET ORGAN(S) OF ATTACK: skin, eyes, upper respiratory tract, gastrointestinal tract, mucous membranes, and central nervous system.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Notify safety personnel of spills. Avoid contact with combustible materials. Do not touch spilled material. For small liquid spills, absorb with sand or other non-combustible inert material. Collect spilled material in appropriate container for disposal.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: Provide approved respiratory apparatus for nonroutine or emergency use. Use an approved filter and vapor respirator when the vapor or mist concentrations are high. Wear gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. An eye wash station and washing facilities should be readily available near handling and use areas.

NOTE: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store in accordance with the Certificate of Analysis for SRM 3168a. Store according to all current regulations and standards. Keep separated from incompatible substances.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Zinc*, 20 June 2003.
MDL Information Systems, Inc., MSDS *Zinc Nitrate*, 19 March 2003.
MDL Information Systems, Inc., MSDS *Nitric Acid*, 19 March 2003.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified value for this material is given in the NIST Certificate of Analysis.